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U. S. DEPARTMENT OF AGRICULTURE.

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Experiment Station Work, XLVIII.

Compiled from the Publications of the Agricultural Experiment Stations.

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AN IMPROVED HOG COT.

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PREPARED IN THE OFFICE OF EXPERIMENT STATIONS.

A. C. TRUE, Director.

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[a] Director.

[b] Special agent in charge.

EXPERIMENT STATION WORK.

Edited by W. H. BEAL and the Staff of the Experiment Station Record.

Experiment Station Work is a subseries of brief popular bulletins compiled from the published reports of the agricultural experiment stations and kindred institutions in this and other countries. The chief object of these publications is to disseminate throughout the country information regarding experiments at the different experiment stations, and thus to acquaint farmers in a general way with the progress of agricultural investigation on its practical side. The results herein reported should for the most part be regarded as tentative and suggestive rather than conclusive. Further experiments may modify them, and experience alone can show how far they will be useful in actual practice. The work of the stations must not be depended upon to produce "rules for farming." How to apply the results of experiments to his own conditions will ever remain the problem of the individual farmer.—A. C. TRUE, Director, Office of Experiment Stations.

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ILLUSTRATIONS.

EXPERIMENT STATION WORK.[a]

PLANT BREEDING ON THE FARM.[b]

Much greater and more rapid progress in the improvement of farm crops would be possible if in general more careful attention were given on the farm to the methods of seed selection and plant breeding. If, for instance, as much time, thought, and effort were devoted to the matter of crop improvement as are given to the bettering of cultural methods and practices the general results would soon force themselves into prominence and a much greater benefit from the work and discoveries of our specialists and scientists would be realized. Dr. H. J. Webber, of the Cornell Station, calls attention to this fact in a recent bulletin and discusses simple methods of plant breeding suitable for the general use of farmers. The crops considered include corn, but the methods of corn breeding have been so fully discussed in previous bulletins that no further account is taken here of this subject.[c] The field selection of seed is also discussed in a previous bulletin of this series.[d]

Certain lines of wheat improvement, particularly those to increase the yield and to better adapt the crop to local conditions, are considered simple enough for any intelligent grower, but methods of seed improvement are seldom found in use. About the only method ordinarily employed is the separation of the plump and heavy seed from the poor and light seed by means of screens and air blasts. Some systematic method of breeding simple enough to be satisfactory for general use should be generally adopted.

Unlike the corn plant, wheat is normally self-fertilized, almost no crossing occurring naturally, and for this reason the individuals or plats grown need not be isolated as in corn breeding. Doctor Webber

[a] A progress record of experimental inquiries, published without assumption of responsibility by the Department for the correctness of the facts and conclusions reported by the stations.

[b] Compiled from California Sta. Bul. 181; Nebraska Sta. Bul. 104; New York Cornell Sta. Bul. 251.

[c] U. S. Dept. Agr., Farmers' Buls. 193, 210, 244, 267.

[d] U. S. Dept. Agr., Farmers' Bul. 84, pp. 8–11.

considers it possible that without resorting to the generally complex methods of hybridization and selection practical farmers may produce valuable varieties and also improve the yield of their own crop. The methods by which this may be accomplished are: (1) The selection of chance variations or sports and the propagation from them of improved varieties; (2) the systematic selection of the best-yielding plants from a well-known race to secure better-yielding strains; and (3) the selection of large heads for seed.

Attention is called to the fact that many of our best varieties or races of wheat have resulted from the application of the first method or by the selection of individual plants of marked superiority. For instance, the popular Fultz wheat had its origin in some beautiful heads of smooth wheat observed in a field of Lancaster Red by Abraham Fultz in 1862. The American races, Wheatland Red, Pride of Butte, and Gold Coin, and the well-known English races, Hopetown and Chevalier, are also accidental seedling variations. The Pride of Butte, a wheat well known in California, was found in a field of rye and saved for trial on account of its extreme vigor. Gold Coin, a seedling sport differing from the hybrid Mediterranean in being bald and white, was found by I. W. Green, of New York, and through five years' selection the type was fixed and the yield increased about 10 per cent.

While sports or mutations of wheat plants are very rare, the farmers watching for such superior plants and testing them are even less numerous, and therefore most of these valuable hints of nature are lost. Every farmer should study different varieties of individual plants until he can recognize exceptional plants as to size of head, yield, quality and size of grain, number of stools, strength of straw, and other desirable qualities. The search for promising plants should be begun as soon as the crop shows mature size of heads, and when such plants are located they should be marked so that the seed may be secured when ripe. This work need not be limited to the selection of actual sports or mutations, but should include generally superior plants, and by selecting as many of these as circumstances will permit the probability of securing an individual of exceptional value is greatly increased. The seed from each selected plant should be kept separate and weighed, if the facilities are at hand, in order that comparisons may be made later on. Each one of these plants, which are the first generation selections, should be given a number and briefly described.

It is recommended that the seed of each plant be planted separately in a short row on a clean and well-tilled piece of ground. These rows may be placed 1 foot apart and about every twentieth row should be planted with some standard variety for comparison. At the beginning of the ripening period the season of maturing of the

different rows must be observed to determine their relative earliness or lateness, and when fully ripe the rows should be compared with each other and with the rows of standard varieties. Only those rows apparently ranking high in yield, free from or least affected by disease, such as rust or smut, showing no tendency to lodging or shattering, and those indicating the greatest hardiness should be selected for further propagation. After the superior rows have been chosen each row must be examined for uniformity of type and all plants not conforming to the general type pulled out and discarded. The grain or seed of each row is harvested and kept separately and given the number of the individual plant first selected. The record of yield, earliness, hardiness, etc., of each number must be carefully preserved.

The seed secured from these first generation selections is used for the propagation of the second generation according to the following plan:

Plant a drill row 17 feet long, using a definite rate of seeding; one-half ounce of seed per row would be at the rate of about 1½ bushels of seed per acre and should be thick enough. These 17-foot rows should be planted 1 foot apart, so that one row represents one-sixteenth of a square rod, or one two-thousand-five-hundred-and-sixtieth of an acre. Plant as many 17-foot rows from each kind as the amount of seed obtained will plant, but if more than one row is planted place them in different parts of the field, in order to obtain a better judgment of the variation due to soil. In planting the 17-foot rows at least every twentieth row should again be planted with a standard variety for comparison.

When the grain is ripe all inferior rows are again discarded, the best rows harvested separately, the grain from each row weighed for comparison with other rows as well as with the standard varieties, and the results recorded.

The third generation is grown in 17-foot rows from the seed of all of the second generation rows selected, and the results of this year should point out the best-yielding strains. It is advised that of a few of the very best and highest-yielding strains somewhat larger plats be grown this year to increase the seed for more extensive planting in the fourth generation. A few of the best-yielding strains should be saved from this year's crop for more extensive trials in the fifth year.

For the fourth generation 17-foot test rows are planted with the strains retained from the third generation and these are compared with some standard variety. If possible, several test rows of the standard varieties should be grown in different parts of the test plat. At maturity the grain of each test row is harvested and weighed separately, as heretofore, and the yield records carefully made and preserved. By comparing the yields of the test rows and increase-plats of each strain for the three years with each other and with the yields of the standard varieties the highest-yielding strains to be

retained for extensive trial may readily be determined. All strains inferior to any other grown and to the standard varieties should be discarded. At this point of the work it is suggested that but two or three strains, or only one, if it is markedly superior, be retained for planting as large a field as possible the following season. If the results show that a superior variety of a high-yielding capacity has been secured the seed should be distributed as extensively as the quantity justifies, and if extensive tests prove it to be a superior variety it should be given a distinctive name.

The method just presented is based upon selecting entire plants and getting the total product of different plants in beginning the selection. In some cases large fine heads from apparently good plants are selected and the product of each head or ear planted in a row by itself, the same as is described for planting individual plants, except that since there will not be seed enough for the 17-foot row the rows are made shorter in accordance with the amount of seed in the heads selected. Ordinarily these will furnish enough for one or two 17-foot rows the next season and the further tests are carried out exactly as already described.

The selection of well-known races to secure high-yielding strains should be carried out in different years in exactly the same way as above outlined. A standard variety, well adapted to local conditions, may be improved by selecting and testing the highest yielding plants. The tests of these plants through the several years are carried out exactly as described for the selection of chance variations and sports.

The simplest application of the method of selecting large heads consists in examining the field of a good standard variety and gathering a quantity of the largest heads, at least enough to make a bushel or more of seed. The following year this seed is grown in an increase-plat and when the grain is ripe it is again gone over and enough large heads gathered for a similar-size plat the third year. The remainder of the crop of this increase-plat is used to plant the general crop of the third year. This method continued year after year will result in good seed for planting.

The methods just described for the improvement of wheat may also be applied to the improvement of oats and barley. The breeding of these crops is much neglected and varieties are frequently very much mixed with different types. It is pointed out that in oat and barley breeding attention should primarily be directed to securing the best-yielding strains for a certain region, and secondarily to producing early or late varieties and to the improvement of the quality of the product. In oats a heavy grain is important and white is the preferable color. In breeding oats and barley careful attention must be given to the susceptibility to disease, lodging, and shattering.

That the grade of seed wheat generally used is not up to the standard was ascertained in an investigation by G. W. Shaw, of the California Station, who secured a large number of samples of seed wheat over a wide area in the Sacramento and San Joaquin valleys of California, to determine the general character of the seed used by the farmers of the State. In general the samples showed that the quality of seed used by most farmers is lacking in purity, perfection of development, weight per bushel, freedom from weeds, and freedom from bunt. It is stated that practically all investigators have found the use of large plump seed and of a high weight per bushel the most profitable. No permanent benefit is believed to be secured from the frequent exchange of seed unless a better type of wheat or a more vigorous strain of the same type is obtained by the exchange. The use of seed from heavy-yielding plants, a plump and heavy grain, a clean wheat, and a pure variety are considered by him the most important points in seed selection.

In this connection the results secured by E. G. Montgomery, of the Nebraska Station, in an experiment with seed wheat and seed oats selected by the use of the fanning mill are of interest. In these experiments heavy seed wheat as separated by the fanning mill did not show an improvement in either yield or quality of grain as compared with light or unseparated seed, and it is believed that no permanent improvement in quality or yield is to be expected from the use of the fanning mill in seed selection.

At first thought it would seem that if "like produces like," the large or heavy seeds should produce the best crop. However, we must recognize the individual plant as the unit for selection, rather than the individual seed. If a single plant of wheat be taken and the kernels thrashed out it will be found that all sizes of kernels are produced by the plant, some large and some small.

As every wheat plant contains both heavy and light seed, the fanning mill gives almost the same kind of wheat so far as inheritance is concerned in the light wheat as in the heavy. It must be remembered that reference is made here to the permanent results which may be expected from the use of the fanning mill and that its use or the use of screens for removing obnoxious weed seed is in no way discouraged, and where a large proportion of the seed grain is shrunken, immature, or damaged this method of seed selection will without doubt increase the following crop by the removal of the poor seed.

SORGHUM FOR SILAGE.[a]

Sorghum has not generally been considered as satisfactory as corn for silage. Professor Plumb, of Ohio State University, states that "sorghum is not so nutritious as Indian corn. The stalks are more

[a] Compiled from Florida Sta. Bul. 92; Illinois Sta. Bul. 101; Kansas Sta. Bul. 123; Tennessee Sta. Bul., Vol. XVII, No. 1.

dense and the silage is not relished quite as well by cattle as that from corn."

In experiments at the Tennessee Station, however, A. M. Soule found that "as fine a quality of silage can be made from sorghum as from any other crop and there seems to be little choice between the feeding values of sorghum and corn silage for beef production." He states that "farmers who experience difficulty in making good silage either cut the crops too green or else have improperly constructed silos."

In the Tennessee experiments the cost of growing an acre of sorghum silage was $19.48, of corn $14.92, corn and sorghum $19.14, soy beans $19.86, but the average cost of a ton of silage from sorghum was $1.41, from corn $2, from corn and sorghum $1.86, and from soy beans $2.83, the higher yield per acre of the sorghum accounting for the lower cost per ton.

Sorghum planted as a "second crop" will not yield more than 8 to 9 tons per acre, whereas if planted as a first crop it will yield from 12 to 20 tons per acre. The lowest cost per ton from a first crop was $1.15 and the highest $1.78; from a second crop the cost was about $2.80.

In the Tennessee experiments Red Head was found to be one of the best varieties for silage purposes. Grown with Virginia ensilage corn a very satisfactory combination for silage was obtained. "Combining these crops makes a better quality of silage, increases the yield, and reduces the cost per ton as compared with corn alone. * * * Corn and sorghum can be combined so that the resulting silage will consist of about equal percentages of each crop."

Sorghum, like corn, contains an excess of carbohydrates and is somewhat deficient in protein. It was found at the Tennessee Station that this could be corrected in a very satisfactory way, and a better balanced silage obtained by growing cowpeas and other leguminous crops with the sorghum and ensiling the two together.

In experiments at the Illinois Station it was found that while "in Illinois corn seems to be the best single crop for the silo * * * under average conditions a larger tonnage of feed can usually be obtained per acre by combining corn, sorghum, and cowpeas or soy beans, but even with this combination the greater part of the crop should be corn."

In comparative tests of different crops for silage at the Kansas Station "cane and Kafir corn gave the largest yields and lowest cost per ton of any of the annual crops, while corn ranked second, and cowpeas third."

The need for forage crops which will give large yields of good forage is becoming more pressing in the South as the raising of live stock increases. J. M. Scott, of the Florida Station, says that the value of sorghum for this purpose has not yet been fully realized. He finds

that sorghum may be grown in all parts of Florida when cultivated and fertilized in practically the same way as corn. It seems to be the best and most productive silage crop that can be grown in Florida. Yields as high as 19 tons per acre were obtained. In the Florida experiments sorghum produced silage richer in total digestible nutrients and gave a larger yield of green forage per acre than corn, thus making it "not only the best crop for the silo, but also the cheapest."

DRY ROT OF CORN.[a]

According to T. J. Burrill and J. T. Barrett, of the Illinois Station, the group of diseases of corn known under the general name of dry rot has become of sufficient economic importance during the past four or five years to cause general concern among farmers in corn-growing regions.

In 1906, the year in which there was the greatest amount of dry rot, so far as any records have been made, the loss was 4.5 per cent of the entire crop in Illinois. This represents a loss of over 15,000,000 bushels, having a value of more than $5,000,000. The loss in 1907 was less than 2 per cent of the crop, or about $2,000,000.

The name dry rot is derived from the way the ears are affected in the field. "In general the husks tend to turn prematurely yellow to sooty, and the ear becomes partially or wholly shriveled and much decreased in weight. Sometimes the ears remain upright with the husks closely adhering to them. In other cases the shanks are weakened and the affected ears hang limp from their attachment, or the diseased condition may not be detected until the husk is removed."

There are several kinds of dry rot, due to different causes. The most common and that which, according to Burrill and Barrett, has during the past two seasons caused about 90 per cent of the damage in Illinois, is due to a fungus known as *Diplodia maydis*. Ears infected with this fungus "shrivel up more or less, darken in color, and become light in weight."

The kernels are also shriveled, very brittle, and loosely attached to the cob. The fungus penetrates all portions of the ear, kernels, cob, and husks, and produces many dark-brown, two-celled spores which serve to propagate the fungus.

There are several other forms of dry rot which are less important but cause considerable damage which seems to be on the increase. These are also due to fungi which belong, for the most part, to the genus Fusarium—members of which cause serious damage to quite a number of our important cultivated plants. * * *

In the case of the Diplodia disease, and quite probably in that of the other forms, the fungus perpetuates itself over winter on the old diseased ears and old stalks. It is not usually difficult to find throughout the summer in old corn fields, where the disease has previously prevailed, many pieces of old cornstalks which are infected with the Diplodia fungus. Stalks known to be two years old have been found still producing spores. During moist periods, spores ooze from these stalks in abundance and are

[a] Compiled from Illinois Sta. Circ. 117.

blown singly or in masses long distances, as has been frequently demonstrated by experiment.

The fungus does not, according to present knowledge, grow upon any other host, and upon developing corn only on the ears. Not so much is known of the other fungi here concerned, but since 90 per cent of the rot is due to Diplodia, less attention need be given to them. Diseased ears are fruitful sources of subsequent infection and should be removed as promptly as possible. This can be readily done, at the time of husking if not before. Keep them in a separate receptacle and burn them as soon as practicable. In addition to this, in fields where any considerable amount of disease has been found, the stalks should also have attention, whatever crop is to follow. Something may be gained by carefully plowing them under and leaving them well covered, but burning may be required even if this is otherwise bad procedure. Such a field should not be replanted to corn for at least two years.

If the first suggestion is always followed and the others are put into practice whenever necessity demands it, these serious losses may be practically prevented.

MANUFACTURE OF STARCH FROM SWEET POTATOES.[a]

With a view to the more complete and profitable utilization of the sweet-potato crop the South Carolina Station several years ago began investigations to determine the starch content of different varieties of sweet potatoes and those most promising for starch making, how much starch can be recovered commercially from the potatoes, and the quality of the starch for commercial purposes.

As it is usually managed at the present time, only a fraction of the crop is disposed of, all unmarketable potatoes being usually a dead loss, and frequently, through inability to market the crop promptly, great loss is suffered through damage by rotting, etc. Where the crop could be disposed of to starch factories the grower would have the following advantages: (1) All potatoes could be sold, regardless of their size. (2) No barrels or containers would be required in marketing the crop. They could be loaded into a wagon in the field and hauled directly to the factory, or to the nearest railroad and loaded into cars for shipment. (3) Grown on such a large scale, modern machinery could be employed in planting, cultivating, and harvesting the crop, thus reducing the cost of growing. (4) Heavier yielding varieties could be grown, which are the ones most valuable for starch production.

The earlier experiments dealing with the economy of the sweet potato as a starch producer have been described in a previous bulletin of this series.[b] The later experiments, which it is the purpose of this article to describe, deal with the methods and economy of the manufacture of starch from sweet potatoes and the commercial value of the product.

Up to the time when the study of the question of producing starch from sweet potatoes was begun at this station, it was a subject that had received practically no attention in this country. It is true, starch was made from this plant on a small scale in the Southern States during the war, but the starch obtained in this way was a comparatively impure product and intended only for home consumption.

It would seem that the sweet potato could be profitably used for this purpose, as it contains a larger percentage of starch than the Irish potato, yields a heavier crop, and

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[a] Compiled from South Carolina Sta. Bul. 136.

[b] U. S. Dept. Agr., Farmers' Bul. 87, p. 26.

can be grown more cheaply. Another advantage it has over the Irish potato is the fact that the vines of the former make a good food for stock—some varieties being very palatable, making good hay and excellent silage. In composition they compare favorably with other forage crops.

The development of cotton manufacturing in the South has created a demand, which is continually increasing, for starch used in "sizing" yarn and "filling" cloth. At present every pound of this starch is brought from other States, principally from the cornstarch factories of New York and Illinois. The experiments which we have had carried out show that for use on cotton goods the starch produced from sweet potatoes is better than cornstarch, and fully equal to the best grades of Irish-potato starch. The annual production of sweet potatoes in the South Atlantic and Gulf States is about 60,000,000 bushels, but this might be easily increased tenfold. The theoretical amount of starch produced per acre from a good crop of sweet potatoes is from one and one-half to four times as much as from corn, wheat, or Irish potatoes per acre.

The variety most in demand for a table potato is not necessarily the one best suited for the manufacture of starch. In fact, we can say almost conclusively that it is not, as the variety containing the largest percentage of starch is apt to be dry and insipid. Then, too, for starch production we want a prolific potato, and as a rule the heaviest yielders are not of the best quality for the table. It has not been fully determined as yet what varieties are best suited for the manufacture of starch. These are the most essential requirements: (1) High starch content; (2) prolificness; (3) flesh light, or white in color. The following come nearer possessing these requirements than any we have thus far examined: Providence, Southern Queen, and Triumph. Further work may show that there are other varieties better suited for this work than any of those mentioned.

The machinery used in the station experiments was similar to that used in making starch from Irish potatoes.

Four varieties of potatoes were used—Southern Queen, Providence, Triumph, and Red Nansemond. The first three were chosen for their high starch content and light color, and one test was made of Red Nansemond to see if the color would interfere with successful starch making.

The results of experiments carried out for two years in succession show the entire practicability of the manufacture of starch from sweet potatoes, but "the data accumulated is yet insufficient to make any positive statement as to whether engaging in this enterprise will prove a paying investment."

At the price at which sweet potatoes are sold at the present time their manufacture into starch alone would not be profitable. It must be remembered, however, that, grown on the scale which would be necessary to run one or more starch factories, there are a number of expenses which could be eliminated. * * *

In the conducting of a factory the following plan suggests itself as a feasible one: The factory to take over all potatoes from the farmer, select the best and even-size ones to be shipped to market for table use, and make starch from the small, oversize, and ill-shaped ones. All operations being controlled in this way by the factory on a large scale, the product could be utilized and marketed to the best advantage. In case of dull market conditions, instead of shipping the potatoes they could be canned, for which there is a great and increasing demand at the present time.

A successful method has also been devised for evaporating sweet potatoes. In this condition they will keep indefinitely, and, owing to their concentrated form,

can be shipped long distances at comparatively small cost. They would, no doubt, be quite popular if better known.

As is the case in all paying enterprises, it would be necessary to watch carefully the by-products and utilize them to the best advantage. A method could undoubtedly be devised for collecting the water with which the potatoes are treated in the grinding operation. This would contain the greater portion of the sugars and could be added to the pulp—from which starch has been extracted—and all sugars, starch, and fermentable matter remaining could be converted into alcohol. It has been shown that, theoretically, 50 gallons of 95 per cent alcohol could be produced from the residues from 100 bushels of potatoes.

It is practically settled that the starch produced from sweet potatoes is of a high grade and suitable for use in many operations where a high-grade starch is required. In all of the tests we have had made not a single adverse report has been received.

In practical tests for laundry purposes, for sizing yarn, filling cloth, thickening colors, etc., the starch gave highly satisfactory results.

PROFITS FROM TOMATO GROWING.[a]

In a recent bulletin of the West Virginia Station, W. M. Munson says:

Next to the potato, the tomato stands, perhaps, at the head of the list of garden vegetables in commercial importance. In Maryland, New Jersey, Delaware, Ohio, Indiana, and to a rapidly increasing extent in West Virginia, the crop is of special importance, while the greenhouses of New York and New England and the newly developed truck fields of Florida endeavor to supply the demand for this fruit in winter.

By far the larger portion of the area devoted to this crop is employed in supplying fruit for the canning factories, and it is the demand of the canneries which more than any other has given the great impetus to tomato culture

It is shown that the canning industry has increased from a pack of about 3,000,000 cases of 24 cans each in 1887 to 13,000,000 cases in 1907. Professor Munson states that the average yield per acre in this country, as grown for the canneries, is 125 to 150 bushels, but that the man who makes a specialty of tomatoes will not be content with less than twice the amount named. "It is better to cultivate fewer acres and cultivate them well than to attempt to cover too much ground. Even at 200 bushels per acre, however, the returns will be far greater than can be derived from wheat, corn, or other farm products."

As regards profits from forcing tomatoes, Professor Munson states that his experience is limited to New York and New England, where, owing to the low temperatures and the excessive number of dark, cloudy days, the yields were not large.

In Maine the yield per plant with the best forcing varieties was 2½ to 3 pounds. In New Jersey the average yield reported is somewhat larger. On the basis of 3 pounds per plant, however, the returns at 30 cents per pound, or 25 cents at wholesale, are very profitable, being about 50 cents per square foot of bench space for each

[a] Compiled from West Virginia Sta. Buls. 116, 117.

crop. Of course these figures can not always be relied upon, for unforeseen conditions frequently arise; but, on the other hand, the experienced gardener will by the use of other crops, as lettuce, radishes, and cucumbers, utilize the space in the house so as to provide against these unforeseen factors.

The opinion is expressed that "as a simple business proposition, however, tomato growing offers excellent opportunities at this time."

Professor Munson summarizes his twenty years' experience in the culture of tomatoes in the field and in the greenhouse substantially as follows:

Field culture.—One of the most important problems in tomato culture is that of earliness. As a rule, plants purchased of the local dealers are drawn and "leggy," being crowded together in small boxes. When set in the field where too often the soil is hard and dry, the shock is such that several weeks are required for the plants to recover and no fruit sets until late in the season. In general, these weak drawn plants are not worth setting.

Frequent transplanting before setting in the field is the best method of securing strong, stocky, well-developed plants. The practice usually followed by the writer has been to sow the seeds in hotbeds, or in shallow boxes in the greenhouses, about April 1. When the first true leaves have well started, or as soon as the plants begin to crowd, transfer to 2-inch pots, and later to 3-inch and 4-inch if occasion demand. As a rule, however, in this climate it will be unnecessary to handle the plants more than twice. In the absence of pots the plants may be handled in boxes, or even in the bed; but pot-grown plants are always preferable, as they are checked less by removal to the field. In the field the plants are set about 4 by 5 feet. Many would plant closer, but on reasonably rich ground the plants will cover the whole surface if set at this distance.

The plants should be set in the field as soon as danger from frost is past. It has commonly been taught that any chill is nearly fatal to young tomato plants; but, as shown by the writer's work at Cornell University and at the Maine Experiment Station, "a chill is not as fatal to success as is commonly supposed." At the Maine Station it was found that "in every instance, save one, the first ripe fruits were obtained from plants set latest." This fact, however, is not necessarily an indication of earliness, as the late-set plants were older than is usually desirable for setting, and the first fruits were in some cases from blossoms formed while in the house. After these had ripened, there was a long interval before others followed. "Without exception the average number of fruits, and the average weight of the product per plant, was in direct ratio with the earliness of setting."

As stated in Bulletin 116 of the West Virginia Station—

The notion that tomatoes do better upon relatively poor soil is erroneous. While it is doubtful if an excessively heavy application of stable manure would be profitable, a liberal application, such as would be given for a good crop of corn, may nearly always be used with advantage. At the Cornell Experiment Station it was found that "the results obtained with liberal manuring, under commercial conditions, * * * certainly show that good stable manure in abundance could be used profitably."

Some of the best tomato soils are the newly cleared areas designed for orchard planting. But on these same new soils, an application of about 500 pounds of a good high-grade complete fertilizer will usually be found advantageous.

Trimming the vines in midsummer as a means of hastening maturity and increasing the yield of fruit is frequently recommended, but very seldom practiced, even by amateurs. In the writer's experience the results obtained justify greater emphasis of this point. As a result of two successive seasons' work at the Maine Experiment

Station it was found that the total increase in the number of fruits matured, due to trimming, ranged from 5.5 per cent to 50 per cent. The percentage gain by weight was very marked, and in one instance reached a total of 58 per cent. In these trials the plants were grown under ordinary field culture. They were started in the greenhouse April 1, planted in the field June 1, and headed back July 24, August 8, and September 5. At each trimming the leading branches were shortened about 6 inches, and most of the side shoots below the first clusters of fruit were removed, the others being shortened. The sunlight was thus freely admitted to the fruit and picking was rendered much easier.

Tomato growing in winter.—Successful tomato culture under glass depends as much upon the man in charge as upon conditions. Eternal vigilance and the exercise of good judgment on the part of the grower are more essential than strict adherence to set rules. The crop is one which demands constant care and intelligent management, but under suitable conditions the returns are very satisfactory, and the product meets a ready demand at good prices.

FIG. 1.—Single-stem plant in forcing house, showing method of tying fruit cluster.

The most important conditions for forcing tomatoes are: A warm, light house—one having a two-thirds span facing the south being preferable—strong bottom heat, rich soil, careful training, uniform temperature, care in watering and pollinating, and, as before suggested, good judgment and constant watchfulness on the part of the grower. Bottom heat is not absolutely essential to success, but the crop matures more quickly if given this condition.

To make the best use of the house two crops should be grown during the season. This will bring each crop on at a season when the expense of heating during a part of the time will be slight. Plants for the first crop should be started as early as the 1st of August. If two or more houses are available, a second sowing should be made in about three weeks, to give a succession. For the second crop seed should be sown during the latter part of October.

The plants are treated in every way as for outdoor culture till handled the last time. For fruiting some prefer benches, with about 6 inches of soil; but, in the writer's experience, the best results have been obtained from the use of boxes 18 inches square and 12 inches deep. In the bottom of the boxes is placed a layer of charcoal, broken pots, or "clinkers" from the furnace, after which soil, consisting of three parts good garden loam and one part well-rotted stable manure, is filled in to within 2 or 3 inches of the top. Each box will hold 4 plants, and the check caused by the partial confinement of the roots seems to be of value in hastening maturity. If the solid bed is used instead of the boxes, the plants are set about 16 inches apart each way, thus occupying a little more than $1\frac{1}{2}$ square feet of floor space for each plant.

Best returns usually follow where the plants are trained to a single stem, as shown in figure 1. Flax cords, about the size of wool twine, are fastened to the corners of

the boxes or to wires placed parallel to each row, for that purpose, and attached above to wires running lengthwise of the building, on the rafters or sashbars. The plants are secured loosely to this support by means of short pieces of raffia. All side shoots should be pinched out as soon as they appear; and when the plants are about 5 feet high, or when 4 clusters of fruit have set, the terminal buds should be pinched off. The vitality of the plant will then be expended in the development of fruit. If the plants are not headed back, other fruit clusters will form, but these scattering later clusters will unduly prolong the fruiting season without giving sufficient financial return to warrant delaying the removal of the old plants.

As the fruit sets the clusters should be supported by means of a small cord or piece of raffia passing around the main stem above a leaf, thus forming a sling. At this time, too, it is well to stir the surface of the soil and work in a quantity of well-rotted manure or to give frequent applications of liquid manure.

The temperature of the house should be as nearly uniform as possible—about 60° F. at night and 70° in dark weather, but 80° or even higher on bright sunny days. All cold drafts and sudden changes of temperature should be rigidly avoided.

Various phases of tomato culture have been discussed in previous Farmers' Bulletins.[a]

THE KEEPING OF APPLES.[b]

In a bulletin of the New Hampshire Station F. W. Morse brings out in a very striking manner the fact that the steady loss of weight which fruits such as apples undergo even under most favorable conditions in storage is due to a process of breathing similar to that occurring in animals, whereby oxygen is taken in and carbon dioxid given out.

Since apples and other fruits have no body heat to maintain, the breathing process is not so active as in animals, and they may last months after being picked from the tree. Yet there is a steady, continuous loss in weight as the weeks go by, although the fruit is sound and firm.

This breathing or respiration is stated to be "partly a chemical reaction, and in apples, like most chemical reactions in the laboratory, it grows more rapid as the fruit becomes warmer and is slowed down when the fruit is cooled." Professor Morse's experiments indicate that these chemical changes "take place from four to six times as fast at summer temperatures as in cold storage, and from two to three times as fast in cool cellars as in cold storage."

There is a practical application of this law to be made to the care of fruit, especially at apple picking time.

It is frequently the case that warm days with temperatures of 70° F. occur in October, and sometimes continue for a considerable period. Fancy apples intended for long keeping in cold storage should be cooled as soon as possible and kept cold. The breathing process is at the expense of cell contents and must weaken the keeping qualities as it goes on. And this destructive action is from four to six times as fast out of cold storage as inside it.

Another fact in connection with the respiration is important. It is not stopped in cold storage, but simply slowed. Apples can not be kept indefinitely, but keep about twice as long in cold storage as in a cool cellar.

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[a] U. S. Dept. Agr., Farmers' Buls. 186, p. 12; 220; 225, p. 17.

[b] Compiled from New Hampshire Sta. Bul. 135.

VITALITY OF WEED SEEDS IN MANURE.[a]

It is well known that there is considerable risk of introducing new weeds by the purchase of manure and hay and other feeding stuffs (see below). E. I. Oswald, of the Maryland Station, undertook to obtain more definite information on this point, especially as regards dissemination through manure, by studying the effect of the fermentation of manure handled in different ways and of passing through the digestive systems of animals on the vitality of various weed seeds, including seeds of about fifty of the worst weeds found in Maryland.

In experiments in which the manure remained (1) for six months in a barnyard heap, and (2) for a short while in piles as when shipped in carload lots from cities, it was found that in the first case there was no danger and in the second case little danger of distributing live weed seeds. In the experiments in which the weed seeds were fed to yearling steers and the manure handled in various ways it was found that—

(1) Where the manure was hauled directly from the stable as a top dressing an average of only 12.8 per cent of the seeds fed to animals germinated.

(2) Where manure was hauled directly from the stable upon the land and plowed under 2.3 per cent of the seeds fed to animals came up.

(3) Where the droppings remained on the pasture fields unadulterated as they fell an average of only 3.1 per cent of the seeds fed to animals germinated.

The results indicate that in general it is safe to assume that the vitality of weed seeds is destroyed in well-rotted manure, but that many pass unharmed through the digestive tracts of animals and may be carried to the land if the manure is not well rotted before use.

WEED SEEDS IN FEEDING STUFFS.[b]

Several of the experiment stations having charge of feeding stuffs inspection have called attention to the danger of dissemination of noxious weeds through the use of feeding stuffs containing weed seeds. Attention has especially been called to this matter by the Maine and Vermont stations. That the danger from this source is quite serious is shown by the fact that it was found on examination at the Maine Station that live weed seeds were found in considerable numbers in many different kinds of feeding stuffs, including bran, middlings, brewers' and distillers' grains, malt sprouts, mixed feeds, chops, stock and dairy feeds, molasses feeds, flax feeds, etc. In some cases as high as 50 per cent of the feed consisted of weed seeds.

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[a] Compiled from Maryland Sta. Bul. 128.

[b] Compiled from Maine Sta. Bul. 156; Vermont Sta. Bul. 131.

"It is quite certain that many of these weed seeds would pass unharmed through the digestive organs of the animals to which they were fed and would find their way to the fields of the owner."

In a bulletin of the Vermont Station J. L. Hills and C. H. Jones, discussing this subject, say:

It is a mattor of common knowledge that there are sold yearly hundreds of carloads of wheat screenings (which being interpreted means in the main weed seeds screened from wheat prior to tho milling process). Sheep and poultry handle them well, but the digestive system of neither horse nor cow is able to destroy them.

In the examinations made at the Vermont Station weed seeds were found to be especially abundant in certain samples of oat feed, mixed wheat feed, and molasses feeds. It is estimated that "the buyer of a ton of one brand of these molasses feeds purchased therein three weed seeds for every square foot of a hundred-acre farm, 129,000,000 weed seeds to a ton, bought and paid for by the farmer who wonders why he is pestered by so many weeds." The Maine Station also found that certain of the molasses feeds were flagrant offenders in the matter of carrying live weed seeds.

The Maine Station calls attention to a particularly objectionable kind of weed seed which is especially likely to occur in injurious amounts in wheat feeds and by-products, viz, cockle. A feed which contains as much of this seed as was found in some of the samples examined by the Maine Station "is objectionable not only on account of the crop of plants which might be grown, but because of its possible injury to stock."

It is thus made clear that the tendency to introduce foul seeds into the seeds and by-products used as feeding stuffs is a serious one.

For the most part there is littlo known as to the nutritive qualities of these wood seeds; occasionally, notably the case with corn cockle, they are poisonous. They are a great menace to clean fields. Naturally the use of these feeds high in foreign wood seeds will tond to tho introduction of undue numbers of undesirablo plants and sometimes of plants unknown to tho State. In somo of the feeding stuffs in the method of proparation they are heated to a high onough temporature to kill the seeds.

The national food and drug law forbids the presence of poisonous weed seeds in poultry and cattle foods. Director Woods of the Maine Station is of the opinion that in addition to enforcing this prohibition of the national law regarding poisonous seeds, it would be desirable and probably practicable for the States to also place a limit to the amount of weed seeds of any kind that should be allowed in feeding stuffs. He says:

It would seem unwise to attempt to regulate the amount of weed seeds that are present in grass seeds and allow an unrestricted sale of feeding stuffs carrying in some casos more dangerous seeds than grass seeds carry.

FORAGE CROPS FOR PIGS.[a]

The question of forage crops for pigs is one which is of decided importance, as it is well known that the use of such feed is valuable and profitable. The question has been studied at a number of the agricultural experiment stations and has been referred to in earlier bulletins of this series.[b] Of more recent work that of the Mississippi, Missouri, and Colorado stations may be mentioned.

Cowpeas without grain have so far given better results at the Mississippi Station, it is stated, than any other of the crops tested. In one season the cowpeas were grown on thin hill land and produced 350 pounds of pork per acre when pigs were grazed upon them. The next season the crop was grown on good valley land and produced 483 pounds of pork per acre. The pigs were turned on the pasturage when the cowpeas were ripe. Alfalfa without grain was found "to be little more than a maintenance ration for hogs." The pigs used in the test, which covered two years, ranged from 3 to 24 months in age.

Alfalfa, clover, rape, and blue grass supplementing corn were compared with rations of corn and ship stuff and corn and skim milk at the Missouri Station. The corn meal, which was of medium fineness, was mixed with water to the consistency of a thick dough and was fed twice daily in such quantities as would be eaten without waste. In the skim-milk ration the meal was wet with milk instead of with water. The green crops were fed twice daily immediately after cutting and were supplied ad libitum. The rape was rather large and coarse and only the fresh green leaves were used. Some of the alfalfa was rather too mature and coarse to be eaten with relish but the remainder was considered of fairly satisfactory quality. The red clover and blue grass were for the most part young and tender.

It was not expected that in ordinary farm practice the green material would be cut and fed to the hogs in this manner. At the time the experiment was undertaken, however, it was not feasible to fence off areas of each of these forage crops and graze them; besides, to know what amount of each of these green forage crops was consumed by hogs when full fed on corn was deemed to be information of importance both from a practical and a scientific standpoint. Outside of the extra expense required for cutting and hauling this material to the hogs, it was not considered that they would do so well on this material as if allowed to graze, for when grazing they would be able to select their material and would eat a larger quantity of forage than it was possible to get them to consume in a pen when it was cut and fed to them in the manner described.

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[a] Compiled from Colorado Sta. Bul. 123; Mississippi Sta. Rpt. 1905, p. 14; Missouri Sta. Bul. 79.

[b] U. S. Dept. Agr., Farmers' Buls. 84, 124. See also Farmers' Bul. 205.

The feeding was continued for one hundred and two days, except with the rape-fed lot which was fed for forty days only, the supply of rape being then exhausted. Considering the first forty days, the gains on green feed ranged from 0.58 pound per pig per day on the rape ration to 0.74 pound on corn meal and alfalfa, the gain on corn meal and middlings being 0.61 pound and on corn meal and skim milk 1.53 pounds. Considering the whole test the average daily gain per pig on the rations containing green feed was as follows: Corn meal and blue grass 0.63 pound, corn meal and clover 0.77 pound, corn meal and alfalfa 0.83 pound, corn meal and middlings 0.68 pound, and on corn meal and skim milk 1.61 pounds. The smallest amount of grain per pound of gain, 2.83 pounds, was noted with the corn and skim milk ration, and the largest amount, 5.31 pounds, with the corn meal and blue grass. The gain was most cheaply made on corn meal and skim milk, costing 2.83 cents per pound, and was most expensive on corn meal and middlings, costing 4.07 cents. On the green feeds it ranged from 3 cents on corn meal and alfalfa to 3.96 cents on corn meal and blue grass.

According to Director Waters—

Perhaps the largest single waste occurring on the Missouri farm at the present time is that which comes from the too exclusive use of corn in growing and fattening hogs. The cheapest and most easily applied remedy is a more general use of the proper forage plants in summer and the use of some home-grown protein in winter. It is not of course to be denied that the hog is primarily a grain-consuming animal, but at the same time forage plays an important rôle in economical hog production and deserves far more attention than it has yet received. * * *

It is not safe or even desirable to rely upon a single crop, excepting alfalfa where it is an assured success, to furnish pasture for our hogs throughout the entire season. It is better to arrange for a succession of pastures from the beginning of the season until the hogs are ready for market, making the feed richer and more concentrated toward the close of the season and as we approach the finishing or fattening period. For this purpose the following crops are recommended: Red clover or alfalfa, cowpeas, soy beans.

To provide a crop of cowpeas in the best condition for the hogs, it will be necessary to select some very early maturing sort and sow rather earlier than is advised for a general crop. * * * For the best results the hogs should not be turned on the peas until the first pods are turning yellow. They will, however, make good pasture before this time, and if the hogs are needing pasture it is not advised to wait until that stage of maturity.

In the opinion of Professor Cottrell, of the Colorado Station, farmers living in the Plains region of Colorado will find raising and fattening pigs advantageous, and barley, wheat, milo maize, and Kafir corn are regarded as the surest grain crops for the dry-land farming conditions which there prevail. The importance of supplementing grain is insisted upon.

According to Professor Cottrell—

Grain is high priced in most sections of Colorado, and while a hog should have some grain every day of his life, at least half the weight of a 200-pound hog should be made from roughage—pasture or fodder. The best pasture is alfalfa. * * *

Dwarf Essex rape stands drought fairly well if seeded as soon as the frost is out of the ground. Winter wheat and rye make good early pasture, and sorghum may be seeded in the spring in fields of rye or wheat and will furnish pasture after the grain has dried up.

Good alfalfa hay is the best winter roughage to feed hogs. It can be fed in a rack and will increase the gains and improve the flavor of the pork. In a test made by the writer hogs fed all the grain they would eat gained 400 pounds, while those fed alfalfa hay and grain gained 600 pounds.

Where alfalfa hay is not available good, juicy, sorghum fodder improves the thriftiness of hogs and increases the gains. * * *

Hubbard squash is an excellent feed for fattening hogs and some Colorado farmers use it as an exclusive feed for this purpose, but better gains and finer quality of pork will be secured when some grain is given with it.

In the station work which has been cited opinions differ somewhat as to the most profitable forage crop, as would be expected, since local conditions vary in different regions. All the investigators quoted agree, however, that grain should be supplemented by forage crops in order to secure the best results.

MARKET CLASSES AND GRADES OF HORSES AND MULES.[a]

Believing that "market classes of horses are not well understood, and * * * that a clear setting forth of true market standards will do much toward establishing correct ideals on the part of the horse breeder and producer," R. C. Obrecht, of the Illinois Station, has made an investigation of Chicago and St. Louis horse markets, which are considered similar to other markets of note, with a view to clearly defining market classes and grades of horses and mules. The first fact of importance brought out by this investigation is "that the majority of horses which find their way to [the large] markets do not approach the degree of perfection demanded by the intending purchaser."

A correct understanding of the market classes will enable the farmer to form a better estimate of the value of the horses which he has to sell; for without this the farmer is at a decided disadvantage in selling his horses, not knowing their real market value. In this way he may fail to get what his horses are worth or he may lose a sale by asking too much. Again, it often happens that he fails to distinguish clearly between his good and his poor marketable animals. As a result the dealer takes the desirable ones at a good profit and leaves the undesirable; thus the inferior horses are left in the country to become the parent stock.

Few breeders can follow their consignments to market and so become familiar with actual market demands. As most of the horses that reach the markets are handled

[a] Compiled from Illinois Sta. Bul. 122.

by dealers who make a business of buying in the country and shipping, tho breeder may never know how well he has succeeded in producing a marketable horse that will command a high price.

To form an intelligent estimate of the value of horses or mules, therefore, it is necessary to have a thorough understanding of the market requirements and a correct understanding of the market classes and grades.

The principal factors that determine the market value of horses or mules are: Soundness, conformation, quality, condition, action, age, color, education, and general appearance.

Horses or mules of a general type are grouped into classes, for convenience and a definite understanding; and in most instances the names of the classes are suggestivo of the use to which they are put. The classes of horses are divided into subclasses which embody those of a similar type but slightly different in size, weight, action, or the use to which they are put. Mules are not divided into subclasses.

The market classes are: Draft horses, chunks, wagon horses, carriage horses, road horses, saddle horses, mining mules, cotton mules, sugar mules, farm mules, and draft mules.

Horses.—Draft horses are broad, massive, rugged, and compactly built, with great weight and strength. They stand from 15-3 to 17-2 hands high and in good flesh weigh from 1,600 to 2,200 pounds or more. The class is subdivided into light draft, heavy draft, and loggers.

Chunks are short-legged, broad, heavy-set horses, tho namo of the class being indicative of their conformation. The subclasses are eastern or export, farm, and southern. The class varies in weight from 800 pounds, the lightest of the southern, to 1,550 pounds, tho heaviest of the eastern. They stand from 15 to 15-3 hands high.

Wagon horses are those used principally where business requires quick delivery. They must have good action, a clean set of limbs, good feet and bone with an abundance of quality, be closely coupled, compactly built and havo a deep broad chest indicative of constitution and stamina. In this class are express, delivery wagon, artillery, and fire horses. They stand from 15 to 17-2 hands high and weigh from 1,050 for the light weights of artillery horses to 1,700 pounds for heavy fire horses.

Carriage horses, sometimes spoken of as "heavy harness horses," are full made, round bodied and smoothly turned with an unusual amount of quality, and must possess to a marked degree high action, with a fair amount of speed. They should have a long, well-arched neck, small neat head, a short, well-muscled back, long, level croup, and well-devoloped thighs and quarters. The class is comprised of coach, cob, park, and cab horses. They range in height from 14-1 to 16-1 hands and weigh from 900 to 1,250 pounds.

Road horses are moro lithe in build and angular in form than those of the carriage class. They are sometimes spoken of as drivers or "light harness horses" and are usually driven to light-weight vehiclos. A considerable speed is desired of some of the individuals of this class, which is composed of runabout and roadsters. Thoy range in height from 14-3 to 16 hands and weigh from 900 to 1,150 pounds.

Saddle horses.—In this class are grouped those horses that perform their work under the saddle, the requirements for which are sureness of foot, ease of carriage to the rider, good manners, and ease of control. In order to be sure of foot they must have an obliquo shoulder, high thin withers and a properly set pastern with an abundance of energy. The above qualities together with a short strong back will give strength for carrying weight and also an easy gait. Tho minimum height is 14 hands for a polo

pony and the maximum 16-1 hands for hunters. The weight varies from 850 to 1,250 pounds. Grouped in this class are five-gaited saddlers, three-gaited saddlers, hunters, cavalry horses, and polo ponies.

Mules.—Mining mules are those purchased with which to operate mines. They are heavy boned, rugged, compactly built individuals, with large feet and strong constitution. They range in height from 12 to 16 hands and weigh from 600 to 1,350 pounds.

Cotton mules are lighter boned than miners and not so compactly built. They are round bodied, smoothly turned, and possess considerable quality. They range in height from 13-2 to 15-2 hands and weigh from 750 to 1,100 pounds.

Sugar mules are those shipped south to use on the sugar farms of Georgia, Louisiana, and other Southern States. They are taller, larger, and more breedy looking than cotton mules and have heavier bone. They stand from 16 to 17 hands and weigh from 1,150 to 1,300 pounds.

Farm mules are those purchased to be used on the farms of the Central States. They are somewhat lacking in uniformity of type and many of them are young and somewhat thin in flesh. An average height is from 15-2 to 16 hands and weigh from 900 to 1,250 pounds.

Draft mules are large heavy boned, heavy set mules that possess quality and ruggedness. They are used in cities for heavy teaming and by contractors for all kinds of heavy work, such as railroad grading, etc. They range in height from 16 to 17-2 hands and weigh from 1,200 to 1,600 pounds and upward.

The grades distinguish the good from the poor animals within the classes and subclasses. The grades are choice, good, medium, common, and inferior.

An animal to grade as "choice" must be sound and approach the ideal type, possess quality and finish, have good style and action, and be in good condition. A "good" animal should possess the essential qualities of his class but need not have the quality, condition, and finish necessary to grade as choice. A horse or mule of "medium" grade is likely to be plain in his make-up with a tendency toward coarseness, and somewhat of a lack of symmetry and condition. A lack of style, action, or soundness may also cause him to grade as medium. The lowest grade found in many of the classes is "common." Such individuals are wanting in most of the essential qualities that go to make them desirable. An "inferior" animal is of the lowest possible grade.

Owing to the fact that the point where two classes or grades meet and merge into each other is not always distinct, it is sometimes difficult to say just where certain animals that are not clearly typical should be classified. Again, if the demand exceeds the supply it is sometimes necessary to temporarily draw from a similar class of animals, or the price may advance and in this way equalize the demand. If, on account of a meager demand or an excess supply the price should drop, it is sometimes necessary to place some animals of one class in another, i. e., they will be purchased by a different class of trade.

The breed to which a horse belongs has but little influence upon his market value and the classes are not determined by the breeds, but by the individuality and conformation of the horse; however, a judicious use of choice pure-bred sires is best suited for the production of marketable horses.

Summarized statement of market classes with limits in height and weight.

Classes.	Subclasses.	Height, hands.	Weight, pounds.
Draft horses	Light draft	15-3 to 16-2	1,600 to 1,750
	Heavy draft	16 to 17-2	1,750 to 2,200
	Loggers	16-1 to 17-2	1,700 to 2,200
Chunks	Eastern and export chunks	15 to 16	1,300 to 1,550
	Farm chunks	15 to 15-3	1,200 to 1,400
	Southern chunks	15 to 15-3	800 to 1,250
Wagon horses	Expressers	15-3 to 16-2	1,350 to 1,500
	Delivery wagon	15 to 16	1,100 to 1,400
	Artillery horses	15-1 to 16	1,050 to 1,200
	Fire horses	15 to 17-2	1,200 to 1,700
Carriage horses	Coach	15-1 to 16-1	1,100 to 1,250
	Cobs	14-1 to 15-1	900 to 1,150
	Park horses	15 to 15-3	1,000 to 1,150
	Cab	15-2 to 16-1	1,050 to 1,200
Road horses	Runabout	14-3 to 15-2	900 to 1,050
	Roadster	15 to 16	900 to 1,150
Saddle horses	Five-gaited saddler	15 to 16	900 to 1,200
	Three-gaited saddler:		
	Light Heavy	14-3 to 16	900 to 1,200
	Hunters:		
	Light Middle Heavy	15-2 to 16-1	1,000 to 1,250
	Cavalry horses	15 to 15-3	950 to 1,100
	Polo ponies	14 to 14-2	850 to 1,000
Mining mules		12 to 16	600 to 1,350
Cotton mules		13-2 to 15-2	750 to 1,100
Sugar mules		16 to 17	1,150 to 1,300
Farm mules		15-2 to 16	900 to 1,250
Draft mules		16 to 17-2	1,200 to 1,600

PROFITABLE AND UNPROFITABLE COWS.[a]

This subject has frequently been discussed in the bulletins of this series [b] and the methods of determining profitableness or unprofitableness of individual cows have been quite fully explained. The following "true story" from records made by the Massachusetts Station enforces so strongly and concisely the lesson of the importance of studying the performance of individual cows in a herd with a view to weeding out those that are not only not profitable but are being carried at an actual loss that it is reproduced as it appears in a recent bulletin of the station:

THE PROFITABLE COW.

A year's record.—6,975 pounds milk testing 4.87 per cent fat equal to 340 pounds fat, equal to 396 pounds butter. Food cost of 1 quart milk 2.76 cents; 1 pound butter 22.9 cents. Profit from milk at 3¾ cents a quart, $31.38; from butter at 30 cents a pound, $31.31.

THE UNPROFITABLE COW.

A year's record.—3,141 pounds milk testing 4.38 per cent fat equal to 137.4 pounds fat, equal to 165 pounds butter. Food cost of 1 quart milk, 4.53 cents; 1 pound butter, 39.2 cents. Loss from milk at 3¾ cents per quart, $11.27; loss on butter at 30 cents per pound, $15.22.

Query.—Which kind of cows are you keeping? If you don't know, isn't it about time you found out?

[a] Compiled from Massachusetts Sta. Bul. 120; Circ. 12.

[b] U. S. Dept. Agr., Farmers' Buls. 56, p. 3; 114, p. 21; 162, p. 24; 190, p. 14; 273, p. 21.

HOW TO ASCERTAIN THE PROFITABLE AND UNPROFITABLE COWS IN A HERD.

The same station suggests the following plan by which the farmer can, with "a minimum outlay of time and money, ascertain the profitable and unprofitable cows in his herd:"

WEIGHING THE MILK.

Begin when the cow is fresh and weigh her milk for three consecutive days in each month, preferably about the middle, and record the weight on previously prepared ruled paper. The sum of the amount produced for three days multiplied by 10 gives the amount produced for the month. The amount of milk produced in a portion of a month can be estimated by weighing the milk for one or two days and multiplying by the proper number. Continue the weighing for one year, and from year to year if you would know the whole truth. Preserve yearly summary in permanent record book.

The balance.—Any spring balance or scale will do, but [a] balance with the scale graduated into pounds and tenths, and with a movable pointer so that when the empty pail is suspended the pointer may be made to indicate zero, is to be preferred. [Such] scales cost $3 at any dairy supply house.

SAMPLING THE MILK.

When to sample.—Sample the milk of each cow in the second, fourth, and seventh month after calving; any time during the month will do, but the middle is to be preferred. The average of the three tests will be a fair index of the quality of the milk during the milking period. Thus if the milk tests 3.8, 4.2, and 4.8 per cent fat, the average would be 4.27 per cent for the entire period.

Utensils needed in sampling.—A pint jar for each cow, a small coffee cup or long-handled gill dipper for taking the sample, a box of bichromate of potash or corrosive sublimate tablets for preserving the sample,[a] to be procured of any dairy supply house at a cost of $1 to $1.25 per box.

How to sample.—Powder fine with a knife one-half of a tablet and put in each jar. Milk the cow dry and pour the milk as carefully as possible from one pail to another three times in order to mix it. Do not allow any more frothing (air bubbles) than possible. Dip out a cupful of the milk at once and pour into the jar. Mix the milk with the preservative by a careful rotary motion. Do not shake or turn the jar upside down. Proceed in this manner for four consecutive milkings (two full days). Be sure to mix the milk by the rotary motion each time a sample is added to the jar and keep the jar tightly covered. The jar should be marked with the name and number of the cow.

TESTING THE MILK.

The samples may be tested by the owner of the cow if he has a Babcock machine, glassware, and acid, or it may be taken to the creamery, or in exceptional cases sent to the experiment station.

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[a] A solution of formalin may be used in place of the tablets. It can be procured of any druggist. Add 5 drops with a medicine dropper.

Illustration of year's milk product.

Month.	3 days' yield.	30 days' yield.	Month.	3 days' yield.	30 days' yield.
	Pounds.	*Pounds.*		*Pounds.*	*Pounds.*
January	90 ×10	900	July	48 ×10	480
February	78 ×10	780	August	42 ×10	420
March	72 ×10	720	September	30 ×10	300
April	66 ×10	660	October	20 ×10	200
May	60 ×10	600	November	15 ×10	150
June	54 ×10	540	December	(Dry)	
Total		4,200	Total		1,550

Total 5,750 pounds milk×4.27 (average per cent fat)=245.5 pounds butter fat.

Converting butter fat into butter.—Increase the pounds of butter fat by $\frac{1}{6}$ thus: $\frac{1}{6}$ of 245.5 pounds butter fat=40.9+245.5=286.4 pounds butter produced during the year.

The above method as described is of course not strictly accurate, but sufficiently so to enable the farmer to form a fair estimate of the productive capacity of his cows.

WHAT IS A PROFITABLE COW?

(*a*) **For market milk.**—In order to be considered profitable, a cow should produce 6,000 pounds (2,800 quarts) of 3.5–4 per cent milk yearly, without being forced.

(*b*) **For butter.**—A cow ought to produce 300 pounds of butter yearly—if she does not do it, she is not helping you.

BLACKHEAD IN TURKEYS.[a]

Under favorable conditions turkey raising has proven to be a very profitable industry. Young turkeys are, however, very delicate and require a great deal of care, and destructive diseases sometimes appear to such an extent as to discourage the raising of turkeys. Among the most destructive of turkey diseases, attacking old and young, is the so-called blackhead. This disease has for several years past menaced the formerly profitable and highly developed turkey industry of Rhode Island, and has proved very destructive in other parts of the country. In fact, it is stated that the disease "has practically destroyed the turkey industry of New England and is rapidly depleting western flocks."

C. Curtice, of the Rhode Island Station, in cooperation with the U. S. Department of Agriculture, has made a very careful study of the nature of the disease, its means of transmission, and possible means of prevention or control. E. F. Pernot, of the Oregon Station, finding the disease very destructive in that State, has also made a study of it with a view to finding means of prevention or treatment.

The name blackhead is derived from the fact that the heads of diseased turkeys frequently turn black, although Doctor Curtice states it as his experience "that few young poults have black heads when they die, and that many old turkeys do not." The black appearance of the head, therefore, though common, has no necessary

[a] Compiled from Rhode Island Sta. Buls. 123, 124; Oregon Sta. Bul. 95.

relation to the blackhead disease. Turkeys dying of other diseases may also have the head turn black.

The seat of the disease has been shown to be in the liver and in the cecum or blind intestine. "In the former it is recognizable by discolorations often more or less circular or even quite irregular in form, and often presenting a yellowish appearance." In the cecum the disease is accompanied by great enlargement and the formation of large sores in the cecal wall.

When the disease in the cecum is slight it is doubtful if the affected animals have diarrhea, which is more or less present in other cases. In many of the older poults the droppings will be liquid, and stained orange yellow; this is the most characteristic symptom of all. Sometimes there are blackened blood clots in the droppings, indicating slight hemorrhages. * * * The majority of young poults die after a day or two of droopiness. Adults may droop longer and pass into chronic stages of the disease. Refusal to eat and standing apart constitute late symptoms.

The experiments made by the Rhode Island Station indicate that the disease is not transmitted through the egg and afford strong evidence that while ordinary fowls (hens, guineas, pheasants, etc.) rarely die of the disease, they carry and distribute the disease.

The experiments have shown that by removing the turkey eggs three or four days before hatching, wiping them with a cloth moistened with 90 per cent alcohol, finishing the incubation in a machine, keeping the poults for a few weeks on a disinfected board floor, and placing them in a location remote from ordinary fowl, the losses by blackhead disease prior to reaching maturity may be reduced from a minimum of 80 per cent to from about 15 to 20 per cent.

This shows that the turkeys must be kept away from ordinary fowl as much as possible, and in view of the tendency of partially wild turkeys to roam and remain at a considerable distance from the farm buildings, it is possible that the supposed benefit from introducing wild blood is thus partially explained, and that it is not wholly due to greater immunity of the wild birds.

It is popularly believed that turkeys can not be raised successfully in confinement; one reason may be that they are often confined with ordinary fowl, which give them the disease organisms.

More must be known about the means by which this disease is transmitted before great progress in its practical control can be expected.

As the parasites seem to be easily killed by drying, dry sandy soils would seem to be preferable for turkey rearing, and it is clear that turkeys should be reared away from the house and be kept from all fields where ordinary fowl are likely to forage.

Older turkeys apparently resist the disease better than very young, but "no breed of turkeys thus far tested is immune to the blackhead disease, for all of them, at all ages, so far as tried, have died of it."

The destructive character of this disease and the ease with which it may be distributed suggests that great care should be exercised not to carry turkeys from regions where the disease prevails into regions where it does not exist.

EXTRACTION OF BEESWAX.[a]

In view of the increasing interest in apiculture in Colorado and the lack of definite information on the subject of the extraction of beeswax, an important product of the industry, F. C. Alford, of the Colorado Station, has made a study of the relative efficiency of different methods of extraction now in use. He experimented with solar extractors, those using steam, and those using pressure under water heated sufficiently to melt the wax. In the latter method he used water alone and water containing sulphuric acid.

The solar extractor used by Mr. Alford was simple in construction and can be made by anyone who is handy with tools. It consists of a wooden box about 30 inches long, 16 inches broad, and 6 inches deep. This box is lined with tin and near one end has a wire-cloth screen to allow the melted wax to run down into a pan at the lower end of the box. The waste wax and brood comb were placed in the upper part of the box, which was set at an angle toward the sun and covered with glass, preferably double. The size of the solar extractor will be determined by the amount of wax to be extracted. If desired, a lamp may be used to furnish additional heat. A hole should be cut in the bottom of the box, so that the heat of the lamp will strike the tin lining under the wire screen. The lamp should be protected from the wind. The use of a lamp increased the efficiency of the extractor about 1 per cent. A like increase was obtained by soaking the comb in water for several days before extraction—a practice followed by some bee keepers. Soaking the comb for three days in a 5 per cent solution of sulphuric acid increased the yield of wax about 5 per cent.

Three kinds of steam extractors were tested in these experiments. Tests were also made of pressure under water with and without addition of 5 per cent of sulphuric acid.

Pressing under water.—The comb, with some water, was put in a tub on the stove and the wax allowed to melt, but not to boil. A can was placed under a press and a slatted follower placed in the bottom of the can. Above this was placed a burlap bag and the hot water, melted wax, and comb were poured into the bag, the top of the bag folded over, a slatted follower placed on top and pressure applied by means of a screw. After some of the wax had been forced out, the water and wax were drawn off, the pressure relieved, the "slumgum" stirred, hot water added, and pressure applied again. The can, which fits under the press, has two holes which are stopped by corks. One is at the bottom and the other near the top. By pulling the cork out of the upper hole the wax which has risen to the top can be drawn off and by using the lower hole all of the wax and water can be removed. The whole apparatus must be kept as warm as possible. * * *

Sulphuric acid and pressure under water.—It was thought that the addition of acid to the water in the experiment might increase the efficiency of the method. The comb was heated in a porcelain-lined tub with a solution of 5 per cent commercial sulphuric acid. When the wax had melted it was poured into the sack in the press and pressure

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[a] Compiled from Colorado Sta. Bul. 129.

applied quickly in order not to have the acid in contact with the metal any longer than necessary. The wax and water were drawn off, boiling water added, the slumgum stirred, and pressure applied again. This water was drawn off and put with the rest. As this was an experiment to determine the efficiency of the press a tin can was used, but in practical work it would be necessary to have everything acid proof, as hot acid, even when diluted, is very destructive to most substances. The can could be made of wood or porcelain-lined ware. The latter would probably be the better.

This method was easy to manipulate and rapid and was the most efficient of all the methods used.

The results reported show that "the slumgum from 100 pounds of wax treated by the ordinary solar wax extractor will retain from 34 to 36 pounds of wax, which can be removed by heating with dilute sulphuric acid and pressing under hot water. [With] the best of the steam wax extractors used there remains in the slumgum about 7 pounds of wax which is obtainable by the use of the sulphuric acid and pressure. With the price of wax at 25 cents a pound it would pay to buy old slumgum and remove the wax by this method."

The wax obtained with the steam extractors "did not have a good color, and would have had to be refined before it could be used. The wax from the solar extractors was always a better color than that from the steam extractors. The wax formed by pressure under water was nearly as good in color as the wax from the solar extractors. The wax obtained by pressure under water containing 5 per cent of sulphuric acid was very good in color, in fact, almost as good * * * as most of the wax obtained from the solar extractors."

Wax from old brood comb is too dark to be used for comb foundation, so that some satisfactory method of bleaching must be employed. Various methods of bleaching were therefore tried, but most of them either destroyed the wax or were in themselves poisonous.

As a result of these experiments and from his experience in handling bees and rendering wax Mr. Alford expresses the following opinion:

It is best for the average bee keeper to have a large solar wax extractor, heated by some artificial heat, by means of which most of the wax in the lighter colored combs, cappings, and burr combs may be easily rendered. The dark combs may also be treated in this manner and the slumgum stored in barrels until the bee keeper has time to treat it with dilute sulphuric acid and press under water. This method is quick and efficient. If the wax has to be refined it can be done by heating, while inclosed in a canton flannel sack, with a solution containing 5 per cent of hydrogen peroxid and 2 to 5 per cent of sulphuric acid. Both of these chemicals can be bought at the ordinary drug store. The common kind, commercial, should be used.

In mixing the acid and the water care should be taken to always pour the acid gently into the water and not the water into the acid.

The cost of the chemicals compared with the results obtained is very slight.

AN IMPROVED HOG COT.[a]

In a previous article[b] an A-shaped or wigwam hog cot used at the Wisconsin Station was described. Since that article was written the cot has been "considerably modified and improved in order to adapt it to both summer and winter conditions." Figure 2 shows the improved cot. A comparison of this figure with the illustrations in the previous article will show that the main additional features are a

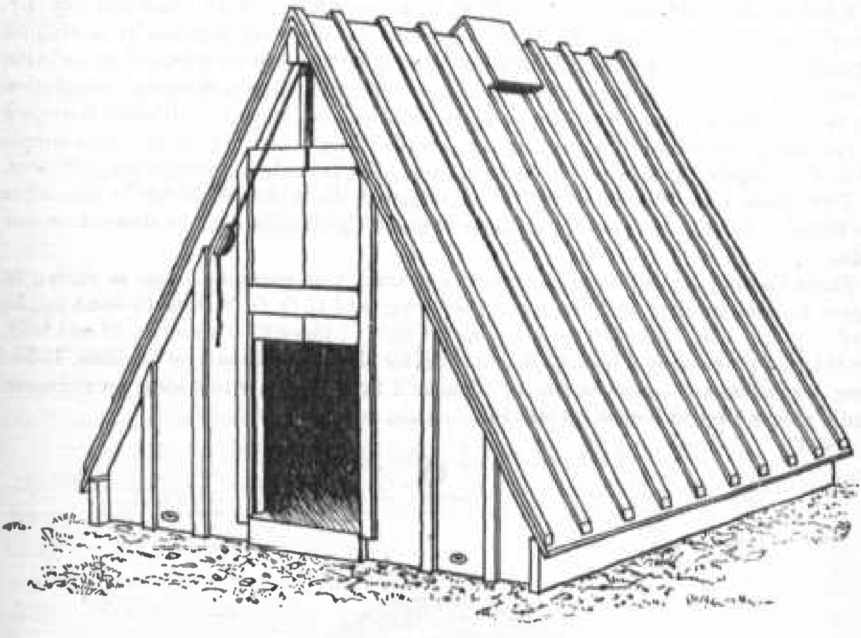

FIG. 2.—Front view of the A-shaped hog cot.

permanent floor, a door in each end, and a ventilating system, all of which greatly increase the stability and utility of the structure.

It is constructed by nailing inch boards on 6 joists 2 by 4 inches by 8 feet long for the floor. Beneath the joists are nailed 3 stringers 2 by 6 inches, 8 feet long, which serve as runners for moving the house. Next is spiked a piece 2 by 8 inches, 9 feet 4 inches long, at the ends of the joists, having the bottom of the 2 by 8 even with the bottom of the joist which will allow it to project above the floor 3 inches. It will also extend out 7 inches at each end. This 2 by 8 forms a plate to which the rafters and roof boards are nailed. The 7-inch extension of the plate at the ends supports the lower corners of the roof which otherwise would be easily split off. These 2 by 8's, besides strengthening the house, raise the rafters and roof boards nailed to them at least 3 inches off the floor and thereby materially increase the floor space and the capacity of the house.

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[a] Compiled from Wisconsin Sta. Rpt. 1907, p. 41.

[b] U. S. Dept. Agr., Farmers' Bul. 296, p. 27.

If the house is to be used in extremely cold weather an easily manipulated door is necessary. The cut shows a door 2 feet wide and 2 feet 6 inches high, made to slide up and down and held in place by cleats. It is suspended by a rope which passes through a pulley at the top and is fastened to a cleat at the side near the roof. The cut also shows two iron eyes, bolted into the front joist of the building, to which the hitch is made when the building is moved.

A rear door, identical in size with the front door, is held in place by cleats nailed across it on the inside and by buttons fastened on the outside. This door is not opened regularly, but provides ventilation in summer and aids in handling sows at farrowing time. Above the rear door is a small sliding door, 8 by 12 inches, to admit light and air.

Another important feature of this house is the ventilator, which is a small cap covering a hole at the top and the center of the roof. The hole is made by sawing off opposite ends of two roof boards and covering it with a cap so arranged as to leave openings 3 inches by 12 inches on each side of the roof. This is sufficient ventilation for two or three animals when all the doors are shut, and if more ventilation is desired it can easily be secured by opening the small sliding door in the rear. This simple plan of ventilation avoids any direct drafts upon the animals and proves very efficient.

With these improvements the cost in building the A-shaped house is somewhat increased. All the boards except those used for the floor should be dressed on one side.

The following lumber is necessary to construct this portable house as shown in figure 2: Nine pieces 1 by 12 inches, 16 feet long, and 11 O. G. battens 16 feet long, for roof; 5 pieces 1 by 12 inches, 14 feet long, for ends; 1 piece 2 by 4 inches, 10 feet long, for ridge; 2 pieces 2 by 8 inches, 10 feet long, for plates; 7 pieces 2 by 4 inches, 16 feet long, for rafters and braces in frame; 3 pieces 2 by 6 inches, 8 feet long, for stringers; and 4 pieces 1 by 12 inches, 16 feet long, rough, for flooring.

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